

CLAIMS

What is Claimed Is:

1. A flex circuit interface coupling providing a micro-actuator control bundle to a micro-actuator for positioning a read-write head, for each of at least N of said read-write heads
5 included in a voice coil actuator for a disk drive, comprising:

a source control bundle respectively coupling to said micro-actuator control bundle, for each of said N read-write heads; wherein said N is at least one;

wherein each member of the control bundle collection comprising said source control bundle, and said micro-actuator control bundle, for each of said read-write heads, comprises a
10 first of a control signal;

wherein, for each of said read-write heads, said source control bundle respectively coupling to said micro-actuator control bundle, further comprises:

said first control signal of said source control bundle coupling to said first control signal of said micro-actuator control bundle.

15 2. The apparatus of Claim 1, wherein each member of the control bundle collection comprising said source control bundle, and said micro-actuator control bundle, for each of said read-write heads, comprises a second of a control signal;

wherein, for each of said read-write heads, said source control bundle respectively
20 coupling to said micro-actuator control bundle, further comprises:

said second control signal of said source control bundle coupling to said second control signal of said micro-actuator control bundle.

3. The apparatus of Claim 1, wherein said N is at least one.

25 4. A main flex circuit compatible with the flex circuit constraints of said voice coil actuator of Claim 1, comprising:

a bridge coupling region providing said source control bundle coupling to said micro-actuator control bundle on a bridge flex circuit, for each of said N micro-actuators.

5 5. Said bridge flex circuit compatible with the flex circuit constraints of said voice coil actuator of Claim 4, comprising a coupling site matching said bridge coupling region on said main flex circuit.

10 6. A flex circuit assembly comprising said main flex circuit of Claim 5 coupling with each of said bridge flex circuits, sharing said source control bundle with said micro-actuator control bundles, for each of said N read-write heads.

 7. Said voice coil actuator, comprising: said flex circuit assembly of Claim 6 coupling with said N of said read-write heads and coupling with said N of said micro-actuators, further comprising:

15 said source control bundle of said main flex circuit shared with said micro-actuator control bundle of said micro-actuator, for each of said N micro-actuators;

 wherein each of said read-write heads is at least partly positioned by a separate of said micro-actuators, for each of said N read-write heads.

20 8. The apparatus of Claim 7, wherein said micro-actuator positioning said read-write head, for at least one of said read-write heads, is a member of the collection comprising:

 said micro-actuator co-located with said read-write head; and
 said micro-actuator non co-located with said read-write head.

25 9. The apparatus of Claim 8, wherein said micro-actuator positioning said read-write head, for each of said read-write heads, is a member of the collection comprising:

 said micro-actuator co-located with said read-write head; and
 said micro-actuator non co-located with said read-write head.

10. A hard disk drive including said voice coil actuator of Claim 7; and a servo-controller providing control of said source control bundle to said main flex circuit coupled to said bridge flex circuits.

5 11. The apparatus of Claim 1, wherein said disk drive uses an optical disk; and wherein said read-write heads at least read data in a track accessed on disk surfaces.

12. A method operating a hard disk drive, comprising the steps of:
generating a control signal bundle by a piezo driver based upon directions provided by a
10 servo-controller to position one of N of read-write heads over a track on a rotating disk surface in said hard disk drive; wherein said N is at least two;

sharing said control signal bundle to a micro-actuator control signal bundle for a separate micro-actuator, for each of said read-write heads;

each of said micro-actuators responding to said micro-actuator control signal bundle to
15 position each of said read-writes, further comprising the step of:

said micro-actuator of said one read-write head, position said one-read-write head of said track on said rotating disk surface.

13. A method making a bridge flex circuit, comprising the steps of:
20 probing said bridge flex circuit coupled with a test strip providing a probe point for testing for a micro-actuator control bundle through said bridge flex circuit, to create a bridge flex probe of said micro-actuator control bundle; and

removing said test strip near a cleavage line to create said bridge flex circuit, when
probing said bridge flex circuit includes said test for said micro-actuator control bundle is
25 successful.

14. The method of Claim 13, wherein said micro-actuator control bundle includes at least a first control signal.

15. Said bridge flex circuit as a product of the process of Claim 13.

16. A method of making a flex circuit assembly using at least N of said bridge flex circuits of Claim 15, comprising the steps of:

5 using a main flex circuit including a bridge coupling region aligned with a bridge coupling site on said bridge flex circuit, for each of said bridge flex circuits to create an aligned main flex circuit and bridge flex circuits; and

reflow soldering said aligned main flex circuit and bridge flex circuits to create said flex circuit assembly;

10 wherein said flex circuit assembly includes said main flex circuit providing a source control bundle which is shared with said micro-actuator control bundle of said bridge flex circuit, for each of said bridge flex circuits in said flex circuit assembly;

wherein said N is at least one.

15 17. Said flex circuit assembly as a product of the process of Claim 16.

18. A method of making a voice coil actuator using said flex circuit assembly of Claim 17, comprising the step of:

20 assembling said flex circuit assembly with said N of a head gimbal assembly and at least one actuator arm, further comprising the steps of:

coupling said micro-actuator control bundle of said bridge flex circuit to a micro-actuator included in said head gimbal assembly.

19. Said voice coil actuator as a product of the process of Claim 18.

25 20. A method of making a disk drive using said voice coil actuator of Claim 19, comprising the step of:

coupling said voice coil actuator via a ribbon cable to an embedded disk controller printed circuit board; wherein said embedded disk controller printed circuit board includes a piezo driver for driving said source control bundle via said ribbon cable;

wherein said disk drive includes said voice coil actuator coupled via said ribbon cable to
5 said embedded disk controller printed circuit board.

21. Said disk drive as a product of the process of Claim 19.

22. Said disk drive of Claim 21 is a member of the collection comprising a head disk drive and an optical disk drive.